



## Microphone Preamplifiers

types 2633, 2639, 2645, 2660

### FEATURES:

- Wide dynamic range
- Very low inherent noise
- Small compact construction
- High input impedance
- Low output impedance
- Adapt to microphones with different diameters

### ADDITIONAL FEATURES TYPE 2645:

- Insert voltage calibration facility
- Conforms with IEC 327, 486 and ANSI S1.10

### ADDITIONAL FEATURES TYPE 2660:

- Selectable 0dB or +20dB gain
- Assembly noise floor of -2,5dB(A) with B & K Condenser Microphone Type 4179

### USES:

- Sound measurements with B & K Condenser Microphones
- General-purpose transducer preamplifier and high impedance input probe for B & K Measuring Amplifiers and Frequency Analyzers

### ADDITIONAL USES TYPE 2645:

- Insert voltage calibration of condenser microphones for open circuit voltage determination
- Calibration of condenser microphones in connection with reciprocity calibration apparatus
- Calibration of sound measurement set-ups

### ADDITIONAL USES TYPE 2660 (with Type 4179):

- Measurement of very-low sound pressure levels
- Hearing research

### Microphone Preamplifiers Types 2633, 2639, 2645 and 2660

have been developed for use with the wide range of B & K Condenser Microphones available for precision acoustic measurements. They are high-performance FET preamplifiers with very low inherent noise and high input impedance. Low output impedance allows the connection of long extension cables to the associated analysis equipment.

**Type 2633** accepts 1/4" microphones directly and 1/8" types via an adaptor.

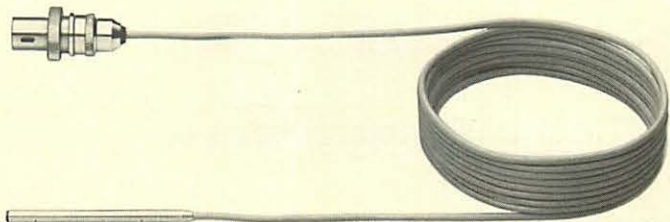
**Type 2639** accepts 1/2" microphones directly and 1", 1/4" and 1/8" types via adaptors.

**Type 2645** is similar in design and performance to Type 2639. In addition, it includes an insert voltage facility for insert voltage and reciprocity calibration of condenser microphones in accordance with IEC 327, 486 and ANSI S1.10.

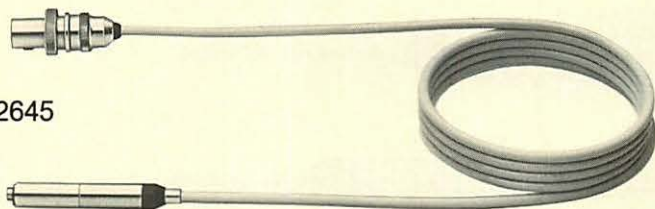
**Type 2660** is primarily intended for use with B & K Condenser Microphone Type 4179. Together, they constitute a system for the measurement of very-low sound pressure levels. Type 2660 may also be used with other B & K Condenser Microphones and provides selectable 0dB or +20dB gain.

The Preamplifiers are robust, compact and designed for operation over a wide range of environmental conditions.

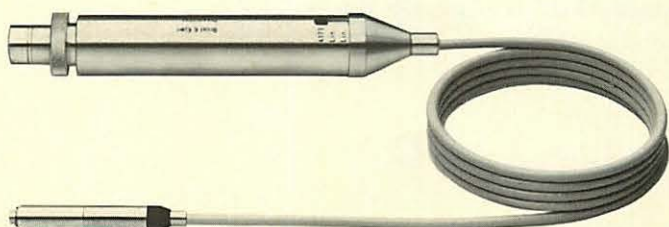
2633



2639, 2645



2660





Preamplifiers Types 2633, 2639, 2645 and 2660 are designed especially to match the needs of the B & K Condenser Microphones, but may find application whenever a very high input impedance is required from the range of B & K Measuring Amplifiers and Frequency Analyzers. The Preamplifiers are small and compact in design and operate over a wide range of temperature, humidity and other environmental effects. They have a very high input impedance and present virtually no load to the microphone cartridges. This together with an extremely low inherent noise level give a low, well-defined lower limiting frequency and a wide dynamic range. The low output impedance of the Preamplifiers allows the connection of long cables between the microphone-preamplifier assembly and the associated measurement equipment.

The Preamplifiers are supplied with power via a 7-core cable from the 7-pin preamplifier input socket fitted to the range of B & K Measuring Amplifiers, Frequency Analyzers, Microphone Power Supplies and Multiplexer Type 2811 (see Specifications). They are connected directly to these instruments in the case of newer types fitted with a shorter preamplifier input socket, or via the supplied Adaptor JE0002 in the case of earlier instruments equipped with a deeper preamplifier input socket. The polarization voltage for the microphone cartridge (0V, 28V or 200V) is supplied from the same preamplifier input socket or power supply via the 7-core cable and the preamplifier itself. Input adaptors connected in place of a microphone cartridge block the polarization voltage, allowing connection of other transducers such as an accelerometer.

These also allow the preamplifier to be used as a general-purpose high impedance input probe.

Fig.1 shows the adaptors required for connecting various B & K Condenser Microphones and direct electrical signals to the preamplifiers. The Dehumidifier shown in Fig.1 is used with special back-vented microphone cartridges for measurements in humid atmospheres over prolonged periods of time.

For use with Condenser Microphone Type 4130, a low cost preamplifier Type 2642 is available. For further details, see the separate Product Data sheet available for Types 4130, 2642 and Microphone Power Supply Type 2810.

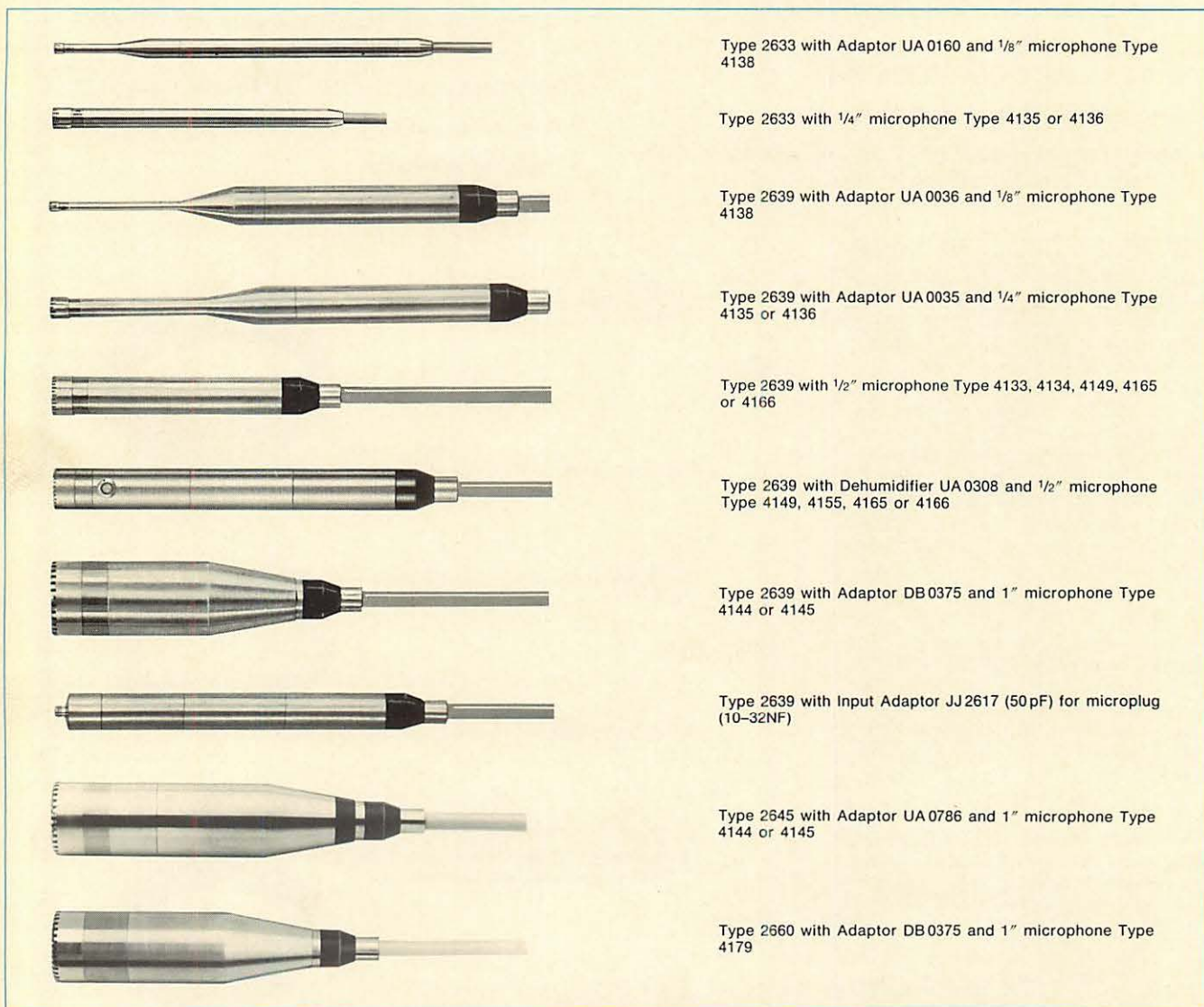


Fig.1. Various assemblies showing the Adaptors required for connecting B & K Condenser Microphones and direct electrical signals to Preamplifiers Types 2633, 2639, 2645 and 2660



Note that use of Pre-polarized Condenser Microphones Types 4129, 4155 and 4176 requires the disconnection of the polarization voltage and grounding of the polarization voltage pin on earlier B & K Measuring Amplifiers, Frequency Analyzers and Power Supplies. Current instruments are provided with a 0V, 28V, 200V polarization voltage selector. For further details of Pre-polarized Condenser Microphones, please see the separate Product Data sheet available for Types 4129, 4155 and 4176.

## Preamplifier Type 2633

Preamplifier Type 2633 is only  $\frac{1}{4}$ " in diameter and fits directly to  $\frac{1}{4}$ " B & K microphones Types 4135 and 4136, while the  $\frac{1}{8}$ " cartridge Type 4138 is fitted by means of Adaptor UA0160. The Preamplifier has a high input impedance and low inherent noise and can be operated from either 120V or 28V DC (Type 2804) supplies.

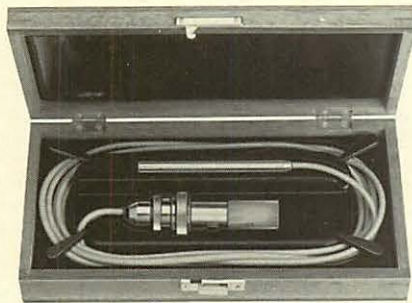


Fig. 2. Type 2633 as delivered in mahogany case

Type 2633 is delivered with Adaptor JE0002 in a mahogany case, as shown in Fig. 2.

## Preamplifier Type 2639

Preamplifier Type 2639 is fitted directly to  $\frac{1}{2}$ " microphone cartridges and adapts to 1",  $\frac{1}{4}$ " and  $\frac{1}{8}$ " cartridges using Adaptors DB 0375, UA0035 and UA0036 respectively. Type 2639 has a high input impedance, very low inherent noise and may be operated either from a 120V DC supply, or from a 28V DC supply such as battery-powered Microphone Power Supply Type 2804. A heater element is built into the tip of the preamplifier to prevent condensation forming in the microphone cartridge if the assembly is used in very humid envi-



Fig. 3. Type 2639S as delivered in mahogany case together with accessories

ronments. Additional protection is obtained using Dehumidifier UA0308 and special back-vented microphones. If the 2639 is used together with Power Supply Type 2804, the current for the heater element must be supplied separately.

The 2639 is available in two different forms, denoted by suffixes "S" and "T":

Type 2639S, shown in Fig. 3, consists of Preamplifier Type 2639 delivered in a mahogany case together with two input adaptors and a flexible extension rod. These accessories are shown in Fig. 4. Adaptor DB0375 is used for fitting 1" microphone cartridges to the 2639, while Coaxial Input Adaptor JJ2617 is used for direct electrical input to the 2639 via cables terminated in microplugs (B & K cables AO0038, AO0122). The Flexible Extension Rod UA0196 is used to increase the distance between the microphone cartridge and preamplifier and to give directional flexibility to the microphone. Increased distance between the preamplifier and transducer allows measurements to be made at higher temperatures, up to 150°C (302°F). In addition, Adaptor JE0002

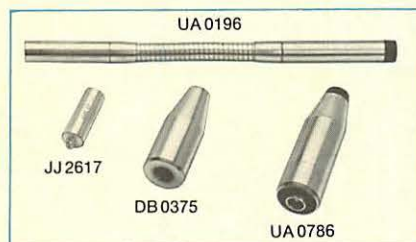


Fig. 4. Accessories delivered with Types 2639S and 2645S: Flexible Extension Rod UA0196,  $\frac{1}{2}$ " to 1" Adaptor DB0375 (2639S only),  $\frac{1}{2}$ " to 1" Adaptor UA0786 (2645S only) and Input Adaptor JJ2617



Fig. 5. Type 2639T as delivered in plastic case

is included for connecting the 2639 to the deeper preamplifier input socket fitted to earlier B & K instruments.

Type 2639T consists of Preamplifier 2639 and Adaptor JE0002 and is delivered in a plastic case (Fig. 5).

## Preamplifier Type 2645

Preamplifier Type 2645 is similar in design and performance to the 2639, but has been designed especially to allow calibration of  $\frac{1}{2}$ " and 1" (using Adaptor UA0786) condenser microphone cartridges by the insert voltage technique, either in conjunction with the reciprocity method or with a known sound source. These methods are described in IEC Publications 327, 486 and ANSI S1.10 - 1966 (R 1976).

Type 2645 fulfils the requirements of these standards and allows insert voltage calibration to be carried out using Measuring Amplifiers Types 2610 and 2636 together with Insert Voltage Junction Unit Type 9585 (System Development) and an external oscillator. Some of the B & K Measuring Amplifiers and Frequency Analyzers, such as Types 2010, 2120 and earlier Types 2606 and 2607, have a direct insert voltage calibration facility.

The Preamplifier may be used in either a driven shield or grounded

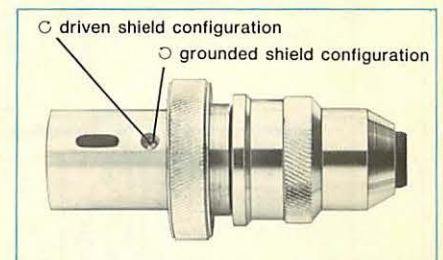


Fig. 6. Type 2645 connection plug. The screw is turned fully clockwise for driven shield operation and fully anti-clockwise for grounded shield operation



shield configuration for compliance with the methods used in standards laboratories throughout the world. Switching between configurations is easily achieved using the screw located in the connection plug, as shown in Fig. 6. For operation in driven shield mode, the screw is turned fully clockwise. For operation in grounded shield mode, the screw is turned fully anti-clockwise.

Type 2645 consists of an input stage, an output stage giving a low output impedance, and the supply for the driven shield surrounding the input stage. The thread which accepts the microphone cartridge is isolated from the preamplifier housing to allow an insert voltage to be applied in series with the microphone for determination of the microphone open circuit sensitivity. A heating element is built into the preamplifier tip to prevent condensation forming in the microphone or preamplifier when the assembly is used in very moist environments. As supplied, the heater supply

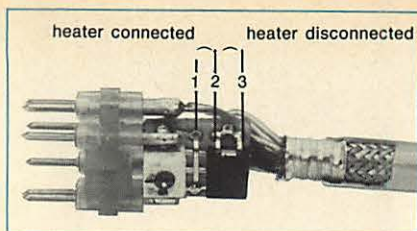


Fig. 7. Type 2645 connection plug with housing removed. As shown the heater is disconnected. To connect the heater supply, the black connector is moved to pins 1 and 2

is disconnected, allowing microphone calibration to be carried out without any temperature influence from the preamplifier heater. To connect the heater supply, the plug casing is removed and a contact is moved from pins 2 and 3 to pins 1 and 2 (Fig. 7).

During the design and manufacture of the preamplifier special care has been taken to minimise stray capacitances and electrical leakage, also when the Preamplifier is used in moist environments. A double screening ensures very low cross-talk.

Preamplifier Type 2645 connects to the 7-pin preamplifier input socket fitted to the range of B & K Measuring Amplifiers, Frequency Analyzers, Microphone Power Supplies, and Multiplexer Type 2811. The preamplifier input socket of these instruments supplies all the necessary powering voltages, microphone polarization voltage, and heater supply voltage for normal operation of the Preamplifier. For insert voltage calibration the Preamplifier may be connected directly to the preamplifier input socket of B & K Frequency Analyzers Types 2010, 2120 and earlier Measuring Amplifiers Types 2606 and 2607, which also supplies the insert voltage. This may originate either from the 1 kHz reference oscillator built into these instruments or from an external signal source such as B & K Sine Generator Type 1023, allowing calibration at other frequencies and signal levels. For other B & K instruments, such as Measuring Amplifiers Types 2610 and 2636, which do not provide a direct insert voltage calibration facility, external junction box

### The Insert Voltage Calibration Technique

The insert voltage technique is primarily used in calibration laboratories for determining the open circuit sensitivity of a condenser microphone. The open circuit sensitivity is defined as the voltage appearing at the output terminals when the microphone is working into an infinitely large electrical impedance.

The insert voltage technique may also be used to provide a convenient means for field-checking the electrical sensitivity of a complete sound measurement system including preamplifier and cables. However, in this case the method does not account for the mechanical pa-

rameters which determine the acoustic properties of the microphone cartridge itself.

The principle of open circuit sensitivity determination using the insert voltage technique is shown in Fig. 8. A well-defined sound pressure level of known frequency is first applied to the microphone. This causes the microphone to generate an internal voltage  $V_0$  — the open circuit output voltage of the microphone — which, when loaded by the preamplifier, produces an output voltage  $V$  at the preamplifier output. The sound source is then switched off and a calibration voltage  $V_1$  — the insert voltage — of the same frequency is applied in series with the microphone. The level

of the insert voltage is then adjusted until the output voltage of the preamplifier is the same as that when the reference sound source was applied ( $V$ ). The open circuit sensitivity of the microphone cartridge is then given by the magnitude of the insert voltage divided by the reference sound pressure.

B & K Microphone Preamplifier Type 2645 has been especially designed for performing open circuit sensitivity calibration of condenser microphones using the insert voltage technique. This technique is described in IEC 327 (1971), 486 (1974) and ANSI S1.10 - 1966 (R 1976).

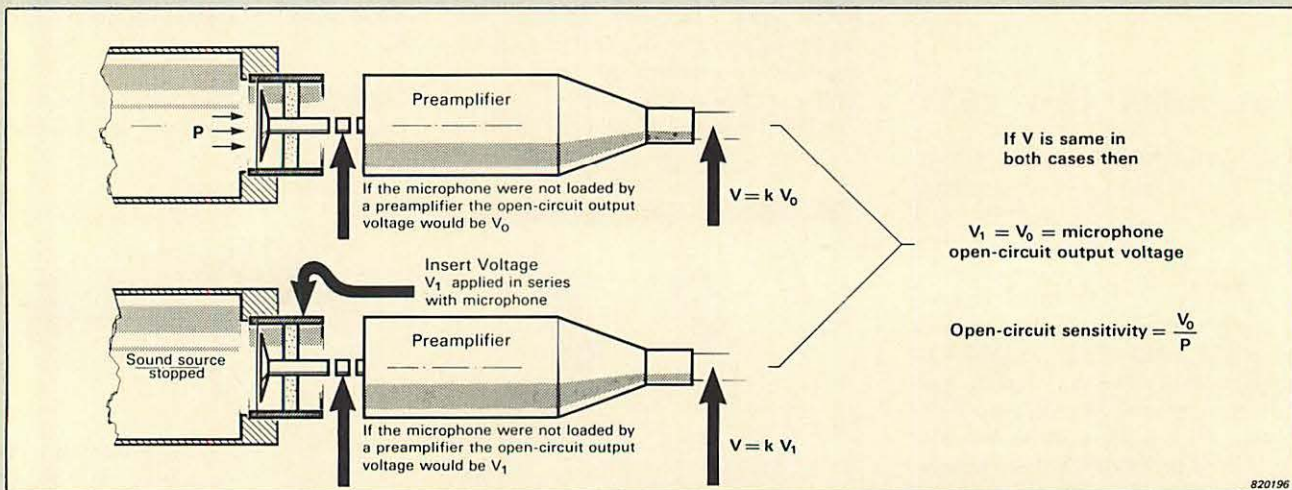


Fig. 8. Insert voltage calibration technique for determining the open circuit sensitivity of a condenser microphone





Fig. 9. Type 2645 S as delivered in mahogany case together with accessories

WB0850 (System Development) and an external oscillator are used. As a sound source, either the Sound Level Calibrator Type 4230 giving a level of 94 dB re 20  $\mu$ Pa at 1 kHz or the Pistonphone Type 4220 giving a level of 124 dB re 20  $\mu$ Pa at 250 Hz may be used.

Type 2645 is also supplied with B&K Reciprocity Calibration Apparatus Type 4143 which is designed for reciprocity calibration of condenser microphones in accordance with IEC 327 and 486, insert voltage calibration, comparison calibration, and the measurement of frequency response of condenser microphones using the electrostatic actuator technique.

Like Type 2639, Preamplifier Type 2645 is available in two forms denoted by suffixes "S" and "T". Type 2645S, shown in Fig. 9, consists of the Preamplifier delivered in a mahogany case together with 1/2" to 1" Adaptor UA0786, Coaxial Input Adaptor JJ2617, Flexible Extension Rod UA0196, Screwdriver QA0001 and Adaptor JE0002. Type 2645T consists of Type 2645, Screwdriver QA0001 and Adaptor JE0002, and is delivered in a plastic case as shown in Fig. 10.



Fig. 10. Type 2645 T as delivered in plastic case

## Preamplifier Type 2660

Preamplifier Type 2660 has been specifically designed for use with one-inch diameter B&K Condenser Microphone Type 4179 which is fitted to the 2660 via 1/2" to 1" Adaptor DB0375. The extremely low inherent noise of both the Preamplifier and the Microphone allows noise measurements to be carried out below the nominal 0 dB re 20  $\mu$ Pa reference level for acoustic measurements, for hearing research investigations and measurements of very-low noise levels. The typical noise floor of the assembly is -2,5 dB(A). Type 2660 may also be used as a normal microphone preamplifier with other B&K Condenser Microphones and provides selectable 0 dB or +20 dB gain. It accepts 1/2" Types directly and 1", 1/4" and 1/8" Types via Adaptors DB0375, UA0035 and UA0036 respectively.

Type 2660 is equipped with a three-position function selector. Fig. 11 shows a simplified block diagram of the 2660, illustrating the signal path in each of the three operation modes:

**"Lin. 0 dB":** In this position the frequency response of the 2660 ranges from 2 Hz to 200 kHz  $\pm$  0,5 dB and the signal is output directly after the 0 dB gain input buffer stage.

**"Lin. +20 dB":** In this position, the signal passes from the input buffer to a low-noise amplifier with +20 dB gain and is output via a second buffer stage. The frequency response of the Preamplifier is linear from 20 Hz to 200 kHz  $\pm$  0,5 dB.

**"4179 +20 dB":** In use with Microphone Type 4179, the function selector is set to the "4179 +20 dB" position. The signal is fed through the input stage, low-noise amplifier and output buffer to a filter network which compensates for the underdamped



Fig. 12. Type 2660 as delivered in mahogany case together with accessories

primary resonance of the 4179 diaphragm system, giving a linear 0° incidence free-field frequency response for the complete system from 7 Hz to 12,5 kHz +2, -3 dB. The system frequency response is in accordance with IEC 651, Type 1.

A heater element is built into the tip of the 2660 for use with microphones under very moist conditions.

Type 2660 is delivered in a mahogany case together with 1/2" to 1" Adaptor DB0375, Coaxial Input Adaptor JJ2617 and Adaptor JE0002, as shown in Fig. 12. Space is provided in the case of the 2660 for storing Type 4179 in its mahogany case.

## Application Ranges

Primarily intended for use with the wide range of condenser microphones available from Brüel & Kjær, the Preamplifiers allow the selection of a microphone-preamplifier assembly to suit the requirements of a particular measurement.

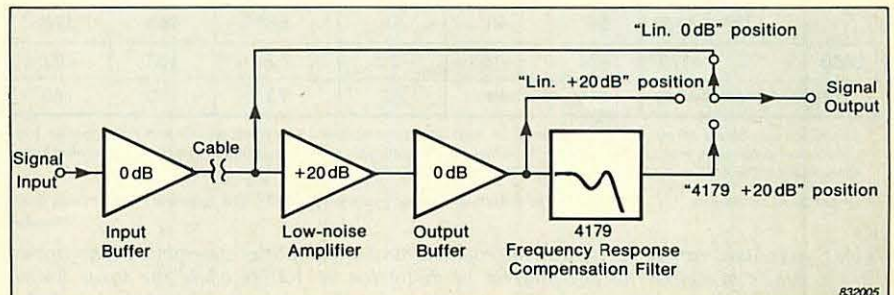


Fig. 11. Simplified block diagram of Type 2660, showing the signal path in each of the three operation modes



In conjunction with Microphones Types 4135, 4136 or 4138, Type 2633 provides an assembly which is ideal for high intensity, high frequency ap-

plications. The small size and compact construction make it suitable for applications such as jet noise and boundary layer investigations.

Type 2639 together with a 1/2" or 1" microphone provides an assembly which is ideally suited for most general sound level measurements. For more special applications, 1/4" and 1/8" Microphones may also be used.

Type 2645 is primarily intended for insert voltage calibration of 1/2" and 1" condenser microphones. In addition, it can be used together with a 1", 1/2", 1/4" or 1/8" microphone for a similar range of applications as Type 2639.

Type 2660 together with B & K Condenser Microphone Type 4179 offers a unique assembly for controlled measurements of very-low-level sound pressures. The Preamplifier has very low inherent noise and may also be used with other Microphones.

The dynamic ranges of some typical B & K Preamplifier and Condenser Microphone assemblies are shown in Table 1. Note that the inherent noise of associated measurement equipment must also be taken into consideration when determining the lower limit of the complete measurement chain.

## Characteristics

### Frequency Response — Transducer Capacitance

The frequency response of the preamplifier depends on the transducer capacitance connected to the preamplifier input and the capacitive load (e.g. due to extension cables) connected to the output. The effects of capacitive load on the preamplifiers is discussed in the next section.

Figs. 13 to 16 show the frequency responses of the Preamplifiers at input signal levels less than the maximum input voltage and with no extension cables connected to the output. Fig. 13 shows the frequency response of Type 2633 fitted with 1/4" (6.4 pF) and 1/8" microphones (3.5 pF). Figs. 14 and 15 show the frequency response of Types 2639 and 2645 respectively, when fitted with different B & K Condenser Microphones. Fig. 16 shows the frequency response of Type 2660 (0 dB and +20 dB gain) with various microphones connected to the input. Typical capacitances of B & K Microphones are:

50 to 60 pF: Types 4144, 4145, 4160, 4179 (1" diameter microphones)

Assembly*			Dynamic Range					
Preamplifier Type	Microphone Type		Lower Limit				Upper Limit	
			3,16 Hz at 1 kHz (dB)	1/3 octave at 1 kHz (dB)	A-weighted Level (dB)	Linear 20 Hz to 20 kHz (dB)	<3% distortion (dB)	<10% distortion (dB)
2633	1/4"	4135	5	23	39	51**	164	174
		4136	13	32	47	59**	172	182
	1/8"	4138	23	43	56	68**	168	178
2639	1"	4144	-24	-5	10	11	146	152
		4145	-21	-2	11	11	146	152
	1/2"	4133	-11	8	22	28**	160	164
		4134	-13	6	21	26	160	164
		4149	-12	7	22	26	160	164
		4165	-18	1	15	17	146	152
	1/4"	4135	4	23	36	44**	164	174
		4136	12	31	43	52**	172	182
	1/8"	4138	26	45	55	66**	168	178
	2645	1"	4144	-23	-4	10	12	146
4145			-20	-1	11	12	146	152
1/2"		4133	-10	9	22	29**	160	164
		4134	-12	7	21	27	160	164
		4149	-11	8	22	27	160	164
		4165	-18	1	16	18	146	152
1/4"		4135	8	27	38	48**	164	174
		4136	14	33	45	56**	172	182
1/8"		4138	26	45	58	68**	168	178
2660		1"	4144	-25	-6	10	11	146
	4145		-22	-3	11	11	146	152
	1/2"	4133	-11	8	22	28**	160	164
		4134	-13	6	21	26	160	164
		4149	-12	7	22	26	160	164
		4165	-18	1	15	17	146	152
	1/4"	4135	4	23	36	44**	164	174
		4136	12	31	43	52**	172	182
	1/8"	4138	26	45	55	66**	168	178
	2660 +	1"	4179*	-34	-16	-2,5	2,6	102
2631***	1/2"	4147	30	49	63	73	150	160

\* Assembly consisting of microphone, adaptor (if any) and preamplifier (only Microphone and Preamplifier Type numbers shown). Note that 2660 in use with 4179 includes +20 dB gain in the preamplifier. For data concerning Types 4160, 4130, 4129, 4155 and 4176, see separate Product Data sheets

\*\* Linear 20 Hz to 200 kHz

\*\*\* For details of Carrier System Type 2631, see separate Product Data Sheet

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Table 1. Dynamic ranges of typical microphone and preamplifier assemblies. The upper limits are given for two degrees of distortion at 100 Hz while the lower limits indicate the typical noise floor of the assembly for various bandwidths of the associated measurement equipment. The limits for 3,16 Hz and 1/3 octave bandwidths are valid at 1 kHz only



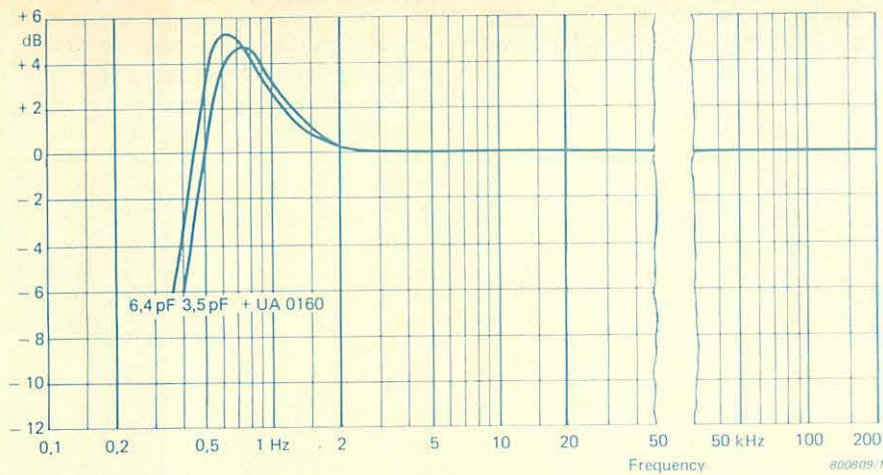


Fig. 13. Frequency response of Preamplifier Type 2633 with different transducer capacitances connected to the input

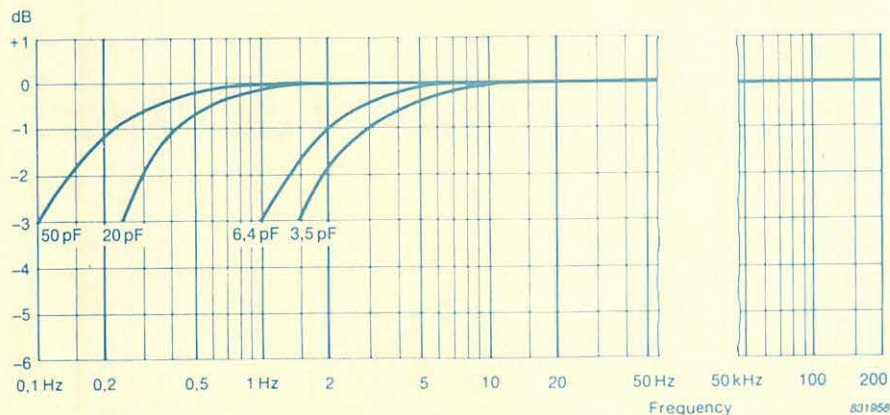


Fig. 14. Frequency response of Preamplifier Type 2639 with different transducer capacitances connected to the input

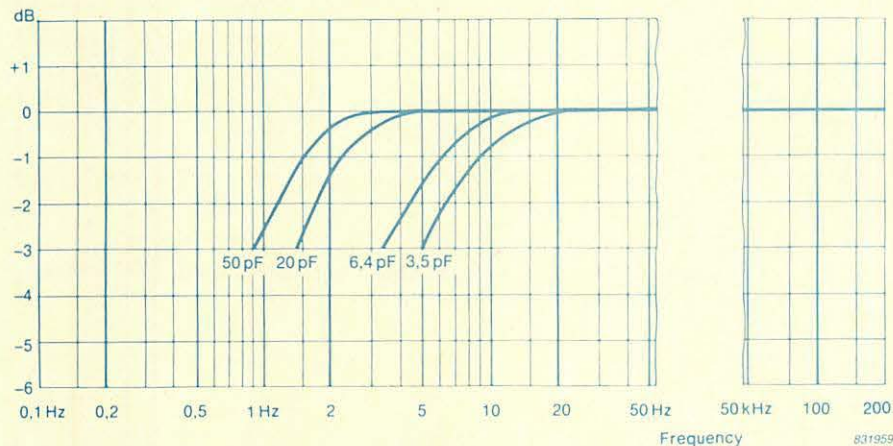


Fig. 15. Frequency response of Preamplifier Type 2645 with different transducer capacitances connected to the input

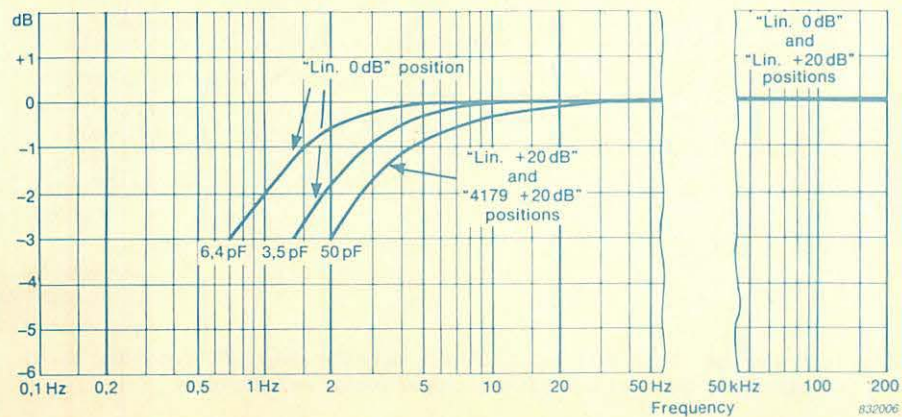


Fig. 16. Frequency response of Preamplifier Type 2660 with different transducer capacitances connected to the input



12,5 to 21 pF: Types 4129, 4130, 4133, 4134, 4147, 4149, 4155, 4165, 4166 and 4176 (1/2" diameter microphones)

6,4 pF: Types 4135 and 4136 (1/4" diameter microphones)

3,5 pF: Type 4138 (1/8" diameter microphone)

### Frequency Response — Capacitive Loading

The capacitive load of extension cables on the output of the preamplifiers influences the frequency response and the upper distortion limit. The influence on the upper distortion limit is dealt with in the following section. The curves given in Figs.17 and 18 show the influence on the high-frequency cut-off at different load capacitances and different transducer capacitances corresponding to those of the B&K condenser microphone cartridges. Fig.17 illustrates this for Type 2633, while Fig.18 shows the effect for Types 2639, 2645 and Type 2660 (0 dB position). When determining the total frequency response of the preamplifier with extension cables, use is made of these curves together with the curves given for Frequency Response — Transducer Capacitance.

### Output Characteristics — Capacitive Loading

If the specified maximum output current of the preamplifier is exceeded, the signal will be distorted. Figs.19., 20., 21., and 22 give the upper distortion limit (3%) as a function of output voltage and load capacitance (cable length) at the output of the preamplifier. Fig.19 shows the effect of capacitive loading for Type 2633 for 120 V and 28 V DC powering. Fig.20 shows the effect for Types 2639 and 2645 for 120 V and 28 V DC powering. Figs.21 and 22 show the output characteristics of Type 2660 in the

Extension Cable	AO0027	AO0028	AO0029
Length	3 m (10 ft.)	10 m (33 ft.)	30 m (100 ft.)
Diameter	6 mm (1/4")	9 mm (3/8")	9 mm (3/8")
Capacitance to ground of the signal conductor	300 pF (100 pF/m)	570 pF (57 pF/m)	1700 pF (57 pF/m)

Table 2. Extension Cables AO0027, AO0028 and AO0029

"Lin. 0dB" and "Lin. +20dB" modes of operation respectively. The characteristics for low-level signals are also shown in Figs.21 and 22.

## Accessories

The Preamplifiers are delivered with certain standard accessories as

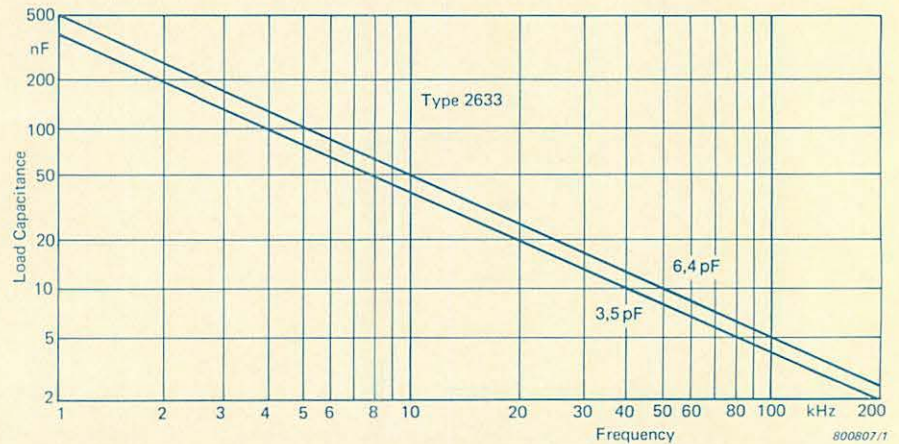


Fig. 17. Upper frequency limit (-1 dB) as a function of load (extension cable capacitance) for Preamplifier Type 2633 with different transducer capacitances connected to the input

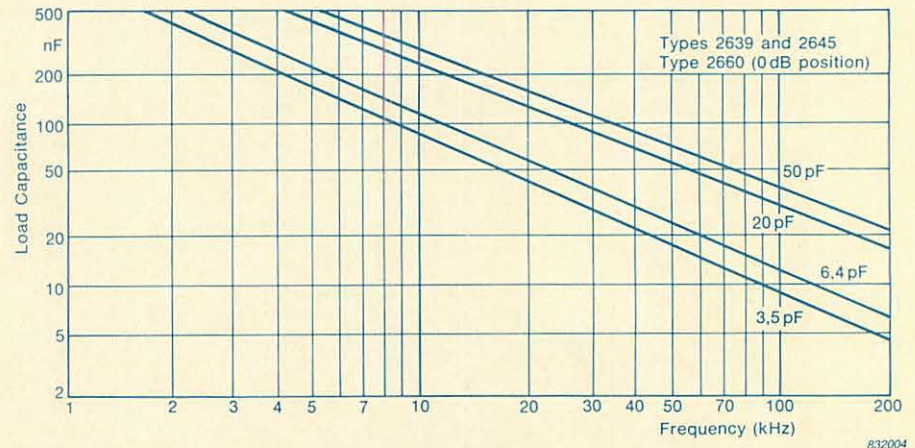


Fig. 18. Upper frequency limit (-1 dB) as a function of load (extension cable capacitance) for Preamplifiers Types 2639, 2645 and 2660 (0 dB gain position) with different transducer capacitances connected to the input

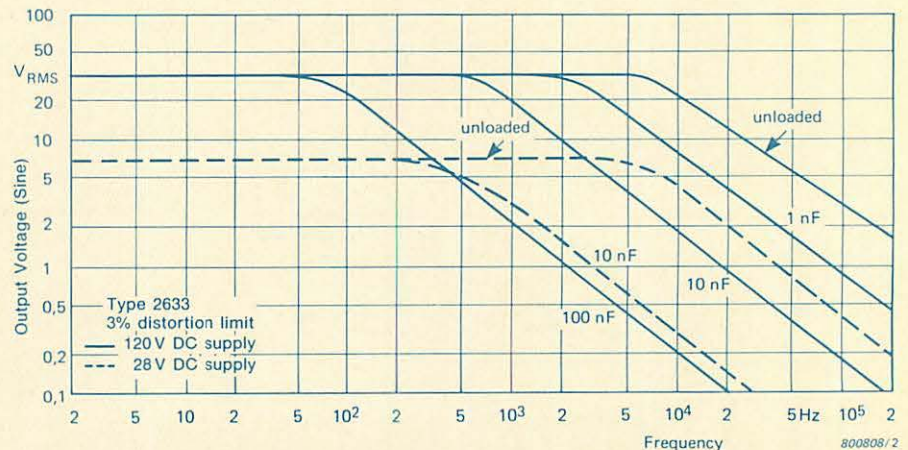


Fig. 19. Preamplifier Type 2633: Upper limit of dynamic range (3% distortion) due to capacitive loading as a function of output voltage and frequency



described in the introductory sections. Full information on accessories available for use with B & K Condenser Microphones and Preamplifiers are given in the Product Data sheet available for the Microphones. A survey of these accessories is given in Fig. 23.

### Extension Cables

Three standard-length extension cables are available. The cables have

very low capacitance and extremely good shielding so that several lengths can be connected together. The influence on distortion characteristics and high frequency response can be seen in Figs. 17 to 22. Table 2 gives the length, diameter and capacitance of the cables.

### Tape Cable AR 0001

This very flat, flexible 7-core cable is

used when it is necessary to carry an extension cable through closed windows, doors, etc. The flat cable can easily follow sharp bends, the thickness being only 0,2 mm. Length of the cable is 300 mm (12 in). Typical applications are in sound insulation and reverberation measurements in buildings.

Fig. 20. Preamplifiers Types 2639 and 2645: Upper limit of dynamic range (3% distortion) due to capacitive loading as a function of output voltage and frequency

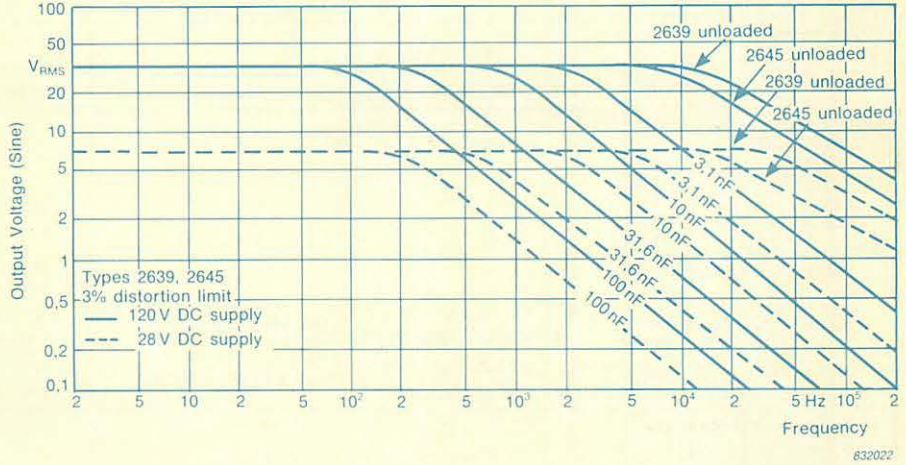


Fig. 21. Preamplifier Type 2660 ("Lin. 0dB" position): Output characteristics for different capacitive loading as a function of output voltage and frequency. See also Fig. 22

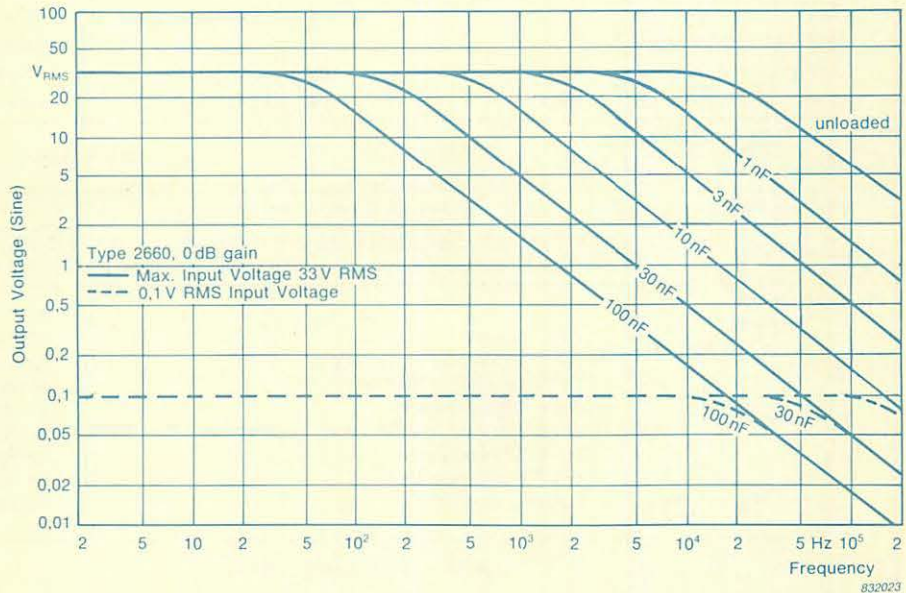
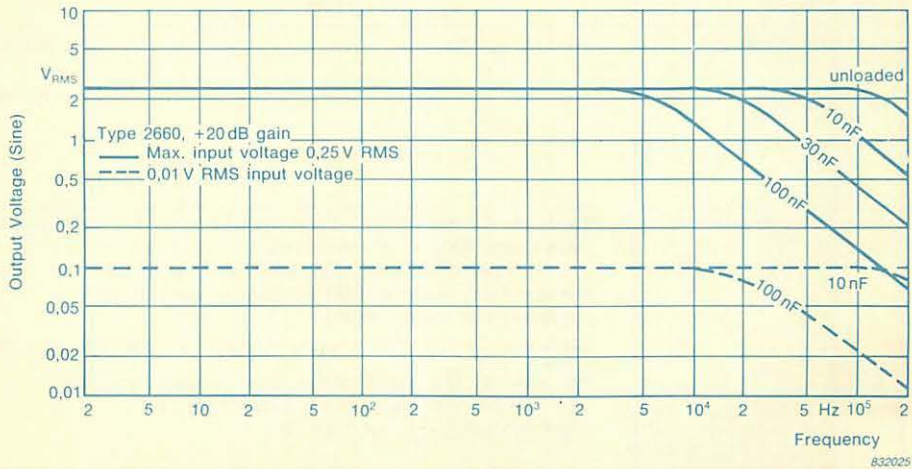
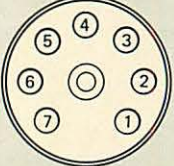


Fig. 22. Preamplifier Type 2660 ("Lin. +20dB" position): Output characteristics for different capacitive loading as a function of output voltage and frequency. See also Fig. 21





# Specifications 2633, 2639,

Preamplifier Type No.	2633		2639	
	120V DC Power	28V DC Power	120V DC Power	28V DC Power
<b>Frequency Range:</b>	3 Hz to 200 kHz $\pm 0,5$ dB (2 Hz: +1 dB, -0 dB)		2 Hz to 200 kHz $\pm 0,5$ dB	
<b>Input Impedance (typ.):</b>	$>50\text{ G}\Omega \parallel 0,25\text{ pF}^*$	$10\text{ G}\Omega \parallel 0,4\text{ pF}$	$23\text{ G}\Omega \parallel 0,15\text{ pF}$	$23\text{ G}\Omega \parallel 0,25\text{ pF}$
<b>Output Impedance:</b>	$<100\ \Omega$	600 $\Omega$ (typ.)	$<50\ \Omega$	
<b>Max. Output Current (peak):</b>	1,5 mA (at $V_{\text{out}} < 4,2\text{ V}_{\text{peak}}$ )	0,25 mA (at $V_{\text{out}} < 1,4\text{ V}_{\text{peak}}$ )	1,5 mA (at $V_{\text{out}} < 4,2\text{ V}_{\text{peak}}$ )	1,3 mA (at $V_{\text{out}} < 1,4\text{ V}_{\text{peak}}$ )
<b>Max. Output Voltage (peak):</b>	45 V (at $I_{\text{out}} < 0,5\text{ mA}_{\text{peak}}$ )	8,5 V (at $I_{\text{out}} < 0,1\text{ mA}_{\text{peak}}$ )	45 V (at $I_{\text{out}} < 0,5\text{ mA}_{\text{peak}}$ )	8,5 V (at $I_{\text{out}} < 0,5\text{ mA}_{\text{peak}}$ )
<b>Attenuation:</b>	$<0,06\text{ dB}$	—	$<0,035\text{ dB}$	$<0,1\text{ dB}$
<b>Output Characteristics:</b>	See Fig. 19		See Fig. 20	
<b>Phase Linearity:</b> unloaded (20 Hz to 20 kHz) (2 Hz to 200 kHz)	within $\pm 2^\circ$ within $+8^\circ, -13^\circ$ (6,4 pF)		within $\pm 2^\circ$ within $\pm 15^\circ$ (20 pF)	
<b>Input Noise:</b> with dummy microphone. A: A-weighted Lin.: Linear 20 Hz to 200 kHz				
50 pF (1" microphone):	—		A: $<1,3\ \mu\text{V}$ , typ. $0,9\ \mu\text{V}$ Lin.: $<6\ \mu\text{V}$ , typ. $3,8\ \mu\text{V}$ (with adaptor DB0375)	
20 pF (1/2" microphone):	—		A: $<2,2\ \mu\text{V}$ , typ. $1,7\ \mu\text{V}$ Lin.: $<8\ \mu\text{V}$ , typ. $5,5\ \mu\text{V}$ (no adaptor required)	
6,4 pF (1/4" microphone):	A: $<7\ \mu\text{V}$ , typ. $5,8\ \mu\text{V}^*$ Lin.: $<30\ \mu\text{V}$ , typ. $19\ \mu\text{V}^*$ (no adaptor required)		A: $<5,5\ \mu\text{V}$ , typ. $4,5\ \mu\text{V}$ Lin.: $<20\ \mu\text{V}$ , typ. $13\ \mu\text{V}$ (with adaptor UA0035)	
3,5 pF (1/8" microphone):	A: $<12\ \mu\text{V}$ , typ. $7\ \mu\text{V}$ Lin.: $<50\ \mu\text{V}$ , typ. $23\ \mu\text{V}$ (with adaptor UA0160)		A: $<15\ \mu\text{V}$ , typ. $10\ \mu\text{V}$ Lin.: $<30\ \mu\text{V}$ typ. $25\ \mu\text{V}$ (with adaptor UA0036)	
<b>Vibration Sensitivity (typ.):</b> with dummy microphone. $1\text{ ms}^{-2}$ in direction of greatest sensitivity				
50 pF (1" microphone):	—		400 $\mu\text{V}$ (with adaptor DB0375)	
20 pF (1/2" microphone):	—		20 $\mu\text{V}$ (no adaptor required)	
6,4 pF (1/4" microphone):	40 $\mu\text{V}$ (no adaptor required)		400 $\mu\text{V}$ (with adaptor UA0035)	
3,5 pF (1/8" microphone):	250 $\mu\text{V}$ (with adaptor UA0160)		1 mV (with adaptor UA0036)	
<b>Magnetic Field Sensitivity:</b> with dummy microphone. $80\text{ Am}^{-1}$ , 50 Hz magnetic field	typically 4 $\mu\text{V}$			
<b>Temperature Range:</b>	$-20$ to $+60^\circ\text{C}$ ( $-4$ to $140^\circ\text{F}$ )*		$-20$ to $+60^\circ\text{C}$ ( $-4$ to $140^\circ\text{F}$ )	
<b>Connector Type:</b>	B & K 7-pin male plug JP0715. Matches female sockets JJ0724 (cable mounting) and JJ0722/3/5 (panel mounting). Also matches 7-pole female sockets JJ0704 (cable mounting) and JJ0703 (panel mounting) with Adaptor JE0002 supplied			
<b>Pin Connections:</b>	 <p>800250 soldering side of plug JP0715 shown</p>			
	pin 1: Ground pin 2: 200V DC Pol. Voltage pin 3: Ground pin 4: Signal Output pin 5: 120V or 28V DC Power Supply pin 6: Not connected pin 7: Not connected Housing: Ground		pin 1: Ground pin 2: 200V DC Pol. Voltage pin 3: Ground pin 4: Signal Output pin 5: 120V DC Power Supply pin 6: 28V DC Power Supply pin 7: Heater Supply Housing: Ground	
<b>Dimensions:</b>	$\varphi 6,35 \times 88\text{ mm}$ ( $\varphi 0,25 \times 3,5\text{ in}$ )		$\varphi 12,7 \times 83\text{ mm}$ ( $\varphi 0,5 \times 3,3\text{ in}$ )	
<b>Cable Length:</b>	3,4 m (11,2 ft.)		2 m (6,6 ft.)	
<b>Accessories Included:</b>	Adaptor JE0002		2639 T: Adaptor JE0002  2639 S: 1/2" to 1" Adaptor DB0375 Coaxial Input Adaptor JJ2617 Flexible Extension Rod UA0196 Adaptor JE0002	
<b>Accessories Available**:</b>	Extension Cables: AO0027, 3 m (9,8 ft.); AO0028, 10 m (32,8 ft.); AO0029, 30 m (98,4 ft.) Tape Cable: AR0001, 300 mm (12 in) Tripod Adaptors: UA0588 and UA0802 for mounting 1/2" and 1" preamplifiers on tripods with 3/8" W thread Portable Floor Stand: UA0587 (includes Adaptor UA0588) Portable Floor Stand: UA0801 Measuring Amplifiers and Frequency Analyzers Types 2609, 2610, 2636, 2010, 2120, 2131, 2134, 2032, 2033, 2034 Portable Two Channel Microphone Power Supply Type 2804 Two Channel Microphone Power Supply Type 2807 Eight Channel Multiplexer Type 2811			

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\* Operating temperature range to  $100^\circ\text{C}$  ( $212^\circ\text{F}$ ) with modified data: Input Impedance: approx.  $5\text{ G}\Omega \parallel 0,25\text{ pF}$  (120V power). Input Noise: approx.  $34\ \mu\text{V}$  A-weighted,  $150\ \mu\text{V}$  Lin. 20 Hz to 200 kHz (6,4 pF, 1/4" microphone)



# 2645, 2660

2645		2660		
120V DC Power	28V DC Power	"Lin. 0dB" Position	"Lin. +20dB" Position	"4179 +20dB" Position
2 Hz to 200 kHz $\pm 0,5$ dB		2 Hz to 200 kHz $\pm 0,5$ dB	20 Hz to 200 kHz $\pm 0,5$ dB	***
6,6 G $\Omega$    0,15 pF	6,6 G $\Omega$    0,25 pF	36 G $\Omega$    0,3 pF		
$< 50 \Omega$		$< 50 \Omega$	50 $\Omega$	
1,5 mA (at $V_{out} < 4,2 V_{peak}$ )	1,3 mA (at $V_{out} < 1,4 V_{peak}$ )	1,5 mA (at $V_{out} < 4,2 V_{peak}$ )	7 mA (at $V_{out} < 1,4 V_{peak}$ )	
45 V (at $I_{out} < 0,5 mA_{peak}$ )	8,5 V (at $I_{out} < 0,5 mA_{peak}$ )	45 V (at $I_{out} < 0,5 mA_{peak}$ )	3,5 V (at $I_{out} < 2,5 mA_{peak}$ )	
$< 0,035$ dB	$< 0,1$ dB	$< 0,035$ dB	+20 dB gain $\pm 0,1$ dB	
See Fig.20		See Fig.21	See Fig.22	
within $\pm 2^\circ$ within $\pm 20^\circ$ (50 pF)		within $\pm 2^\circ$ within $\pm 20^\circ$ (50 pF)	within $\pm 20^\circ$ — (50 pF)	— —
A: $< 1,8 \mu V$ , typ. $1,4 \mu V$ Lin.: $< 7 \mu V$ , typ. $5,5 \mu V$ (with adaptor UA 0786) A: $< 2,8 \mu V$ , typ. $2,2 \mu V$ Lin.: $< 10 \mu V$ , typ. $7 \mu V$ (no adaptor required) A: $< 7 \mu V$ , typ. $5,5 \mu V$ Lin.: $< 25 \mu V$ , typ. $17 \mu V$ (with adaptor UA 0035) A: $< 15 \mu V$ , typ. $11 \mu V$ Lin.: $< 40 \mu V$ , typ. $30 \mu V$ (with adaptor UA 0036)		A: $< 1,1 \mu V$ , typ. $0,8 \mu V$ Lin.: $< 5 \mu V$ , typ. $3,2 \mu V$ (with adaptor DB 0375) A: $< 2,2 \mu V$ , typ. $1,6 \mu V$ Lin.: $< 8 \mu V$ , typ. $5,1 \mu V$ (no adaptor required) A: $< 5,5 \mu V$ , typ. $4,1 \mu V$ Lin.: $< 20 \mu V$ , typ. $11 \mu V$ (with adaptor UA 0035) A: $< 15 \mu V$ , typ. $7,1 \mu V$ Lin.: $< 30 \mu V$ , typ. $23 \mu V$ (with adaptor UA 0036)		A: $< 1,1 \mu V$ (with adaptor DB 0375) — — —
300 $\mu V$ 160 $\mu V$ driven shield 400 $\mu V$ 1 mV	(with adaptor UA 0786) (no adaptor required) (with adaptor UA 0035) (with adaptor UA 0036)	400 $\mu V$ 60 $\mu V$ 400 $\mu V$ 1 mV	(with adaptor DB 0375) (no adaptor required) (with adaptor UA 0035) (with adaptor UA 0036)	
typically 4 $\mu V$				
$-20$ to $+60^\circ C$ ( $-4$ to $140^\circ F$ )		$-20$ to $+60^\circ C$ ( $-4$ to $140^\circ F$ )		
B & K 7-pin male plug JP0715. Matches female sockets JJ0724 (cable mounting) and JJ0722/3/5 (panel mounting). Also matches 7-pole female sockets JJ0704 (cable mounting) and JJ0703 (panel mounting) with Adaptor JE0002 supplied				
pin 1: Ground pin 2: 200 V DC Pol. Voltage pin 3: Insert Signal pin 4: Signal Output pin 5: 120 V DC Power Supply pin 6: 28 V DC Power Supply pin 7: Heater Supply Housing: Ground		pin 1: Ground pin 2: 200 V DC Pol. Voltage pin 3: Ground pin 4: Signal Output pin 5: 120 V DC Power Supply pin 6: 12 V Heater Supply pin 7: 12 V Amplifier Supply Housing: Ground		
$\varphi 12,7 \times 83$ mm ( $\varphi 0,5 \times 3,3$ in) $\varphi 23,6 \times 106$ mm ( $\varphi 0,93 \times 4,2$ in) with Adaptor UA 0786		Pre-amplifier Input Stage: $\varphi 12,7 \times 83$ mm ( $\varphi 0,5 \times 3,3$ in) Pre-amplifier Connector Stage: $\varphi 25 \times 175$ mm ( $\varphi 1,0 \times 6,9$ in)		
2 m (6,6 ft.)		2 m (6,6 ft.)		
2645 T: Screwdriver QA 0001 Adaptor JE 0002 2645 S: $1/2$ " to 1" Adaptor UA 0786 Coaxial Input Adaptor JJ 2617 Flexible Extension Rod UA 0196 Screwdriver QA 0001 Adaptor JE 0002		$1/2$ " to 1" Adaptor DB 0375 Coaxial Input Adaptor JJ 2617 Adaptor JE 0002		
Extension Cables: AO 0027, 3 m (9,8 ft.); AO 0028, 10 m (32,8 ft.); AO 0029, 30 m (98,4 ft.) Tape Cable: AR 0001, 300 mm (12 in) Tripod Adaptors: UA 0588 and UA 0802 for mounting $1/2$ " and 1" preamplifiers on tripods with $3/8$ " W thread Portable Floor Stand: UA 0587 (includes Adaptor UA 0588) Portable Floor Stand: UA 0801 Measuring Amplifiers and Frequency Analyzers Types 2609, 2610, 2636, 2010, 2120, 2131, 2134, 2032, 2033, 2034				
Insert Voltage Junction Unit: Type 9585 Portable Two Channel Microphone Power Supply Type 2804 Two Channel Microphone Power Supply Type 2807 Eight Channel Multiplexer Type 2811		—		

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\*\* For survey of microphone and preamplifier combinations, see Fig. 23.

\*\*\* For details of Type 2660 in use with Microphone Type 4179, see separate Product Data sheet



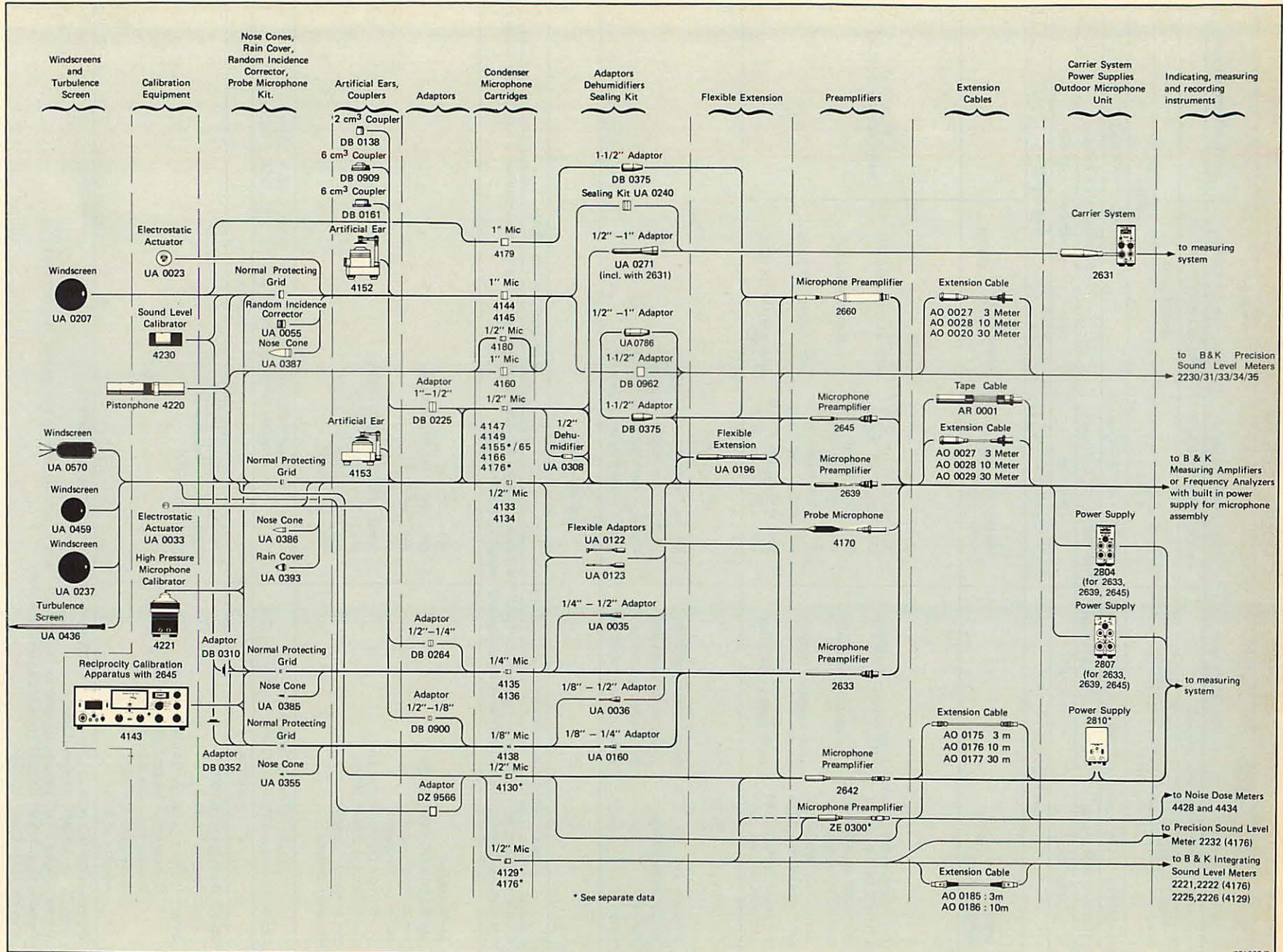


Fig. 23. Survey of B & K Condenser Microphones, Accessories, Adaptors and Microphone Preamplifiers